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13. ABSTRACT (Maximum 200 words) During the reporting period, significant information has been obtained regarding the interaction between otolithic stimulation, semicircular canal stimulation, and visual stimulation. Results, published in a peer-reviewed journal have indicated that whereas human subjects can suppress semicircular canal-induced eye movements by focusing on a head-fixed visual target, subjects have great difficulty suppressing eye movements induced by otolithic stimulation, specifically, eye movements induced by rotation about an off-vertical axis. This difference in visual-vestibular interaction between the semicircular canal-ocular reflexes and the otolith-ocular reflexes suggests that rotational acceleration-induced eye movements and linear acceleration-induced eye movements are generated by different central nervous system pathways. These studies form the basis for future research regarding multi-sensory integration, vestibular-induced eye movements and spatial orientation. Preliminary studies, not yet published, have assessed the ability of normal human subjects to generate <i>volitional</i> eye movements (saccades and pursuit) during vestibular stimulation. The work performed during the reporting period served as the basis for an application to the National Institutes of Health regarding spatial reorientation. That proposal, Grant No. DC01791, when funded, will enable a continuation of the studies begun during the reporting period with funds from AFOSR. Specifically, that project will allow a study of volitional eye movements during vestibular stimulation.					
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During the reporting period, significant information has been obtained regarding the interaction between otolithic stimulation, semicircular canal stimulation, and visual stimulation. Results, published in a peer-reviewed journal article have indicated that whereas human subjects can suppress semicircular canal-induced eye movements by focusing on a head-fixed visual target, subjects have great difficulty suppressing eye movements induced by otolithic stimulation, specifically, eye movements induced by rotation about an off-vertical axis. This difference in visual-vestibular interaction between the semicircular canal-ocular reflexes and the otolith-ocular reflexes suggests that rotational acceleration-induced eye movements and linear acceleration-induced eye movements are generated by different central nervous system pathways. These studies form the basis for future research regarding multi-sensory integration, vestibular-induced eye movements and spatial orientation.

One aim of this study was to further define the eye movement response to combined visual and vestibular stimulation, especially during linear acceleration. Subjects included 15 asymptomatic healthy individuals (8 females and 7 males) between the ages of 20 and 31 years. Vestibular stimulation consisted of earth-vertical axis rotation and off-vertical axis rotation (OVAR). Visual stimuli consisted of projected vertical stripes that were rotated for optokinetic trials and were stationary for visual augmentation trials. A small laser target (0.5 mW, 0.5 deg arc) that rotated with the subject was used for fixation trials. Eye movements were measured with electro-oculography. Results showed that visual-vestibular interaction during sinusoidal rotation was not affected by a 15 deg off-vertical tilt. Constant velocity OVAR induced a continuous nystagmus whose slow component velocity contained a nonzero baseline, i.e. a bias, and a periodic fluctuation at the rotation frequency, i.e. a modulation component. The modulation component during visual fixation was reduced as compared with that seen during rotation in the dark but was not absent. Constant velocity OVAR in the presence of earth-fixed stripes induced a consistent sinusoidal modulation. Our results suggest that visual-vestibular interaction for otolith stimulation differs from visual-vestibular interaction for semicircular canal stimulation. The modulation component of the response to OVAR appears to be modified by visual stimulation to a lesser extent than other vestibular induced eye movements and thus may reflect a more "direct" vestibulo-ocular response. The bias component of the response to OVAR can be substantially influenced by vision and thus may depend upon more "indirect" pathways. The results have been published in the Journal of Vestibular Research 1996; 6(2):93-103, entitled "Visual-vestibular interaction during off-vertical axis rotation".

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